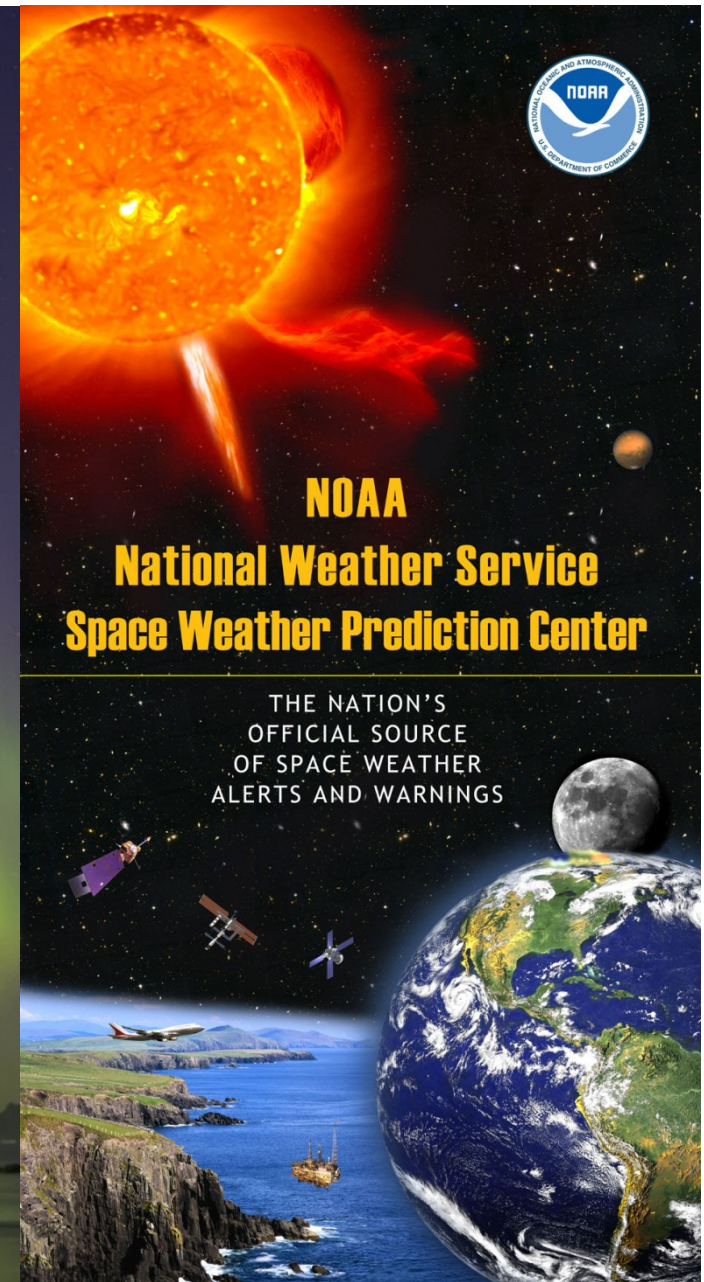


Space Weather: From Science to Forecast to Societal Impact

Dr Thomas J Bogdan

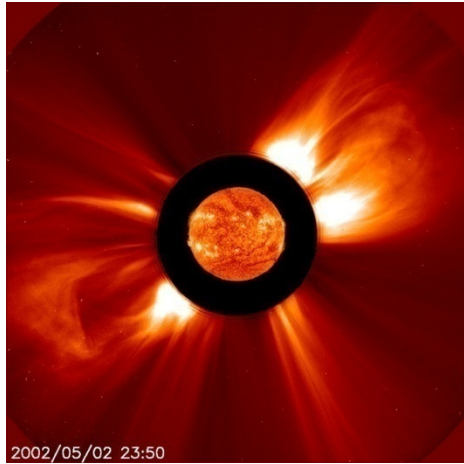
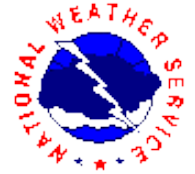
*Director, Space Weather Prediction Center
Boulder, CO*

Space Weather Risks and Society Workshop
15 October 2011





Three Agents of Space Weather



93 Million Miles from Sun to Earth

R-Scale

- > Ultra Violet and X-ray Radiation
8 minutes

S-Scale

- > Charged Particle Radiations
10-30 minutes

NOAA
Space
Weather
Scales

- > Magnetized Blobs of Solar Material
18-96 hours

G-Scale



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Space Weather Impacts From Ultra Violet and X-Ray Radiation



Radio Blackouts

GPS Errors

GPS Loss of Lock

Satellite Drag
(Low Earth Orbit)

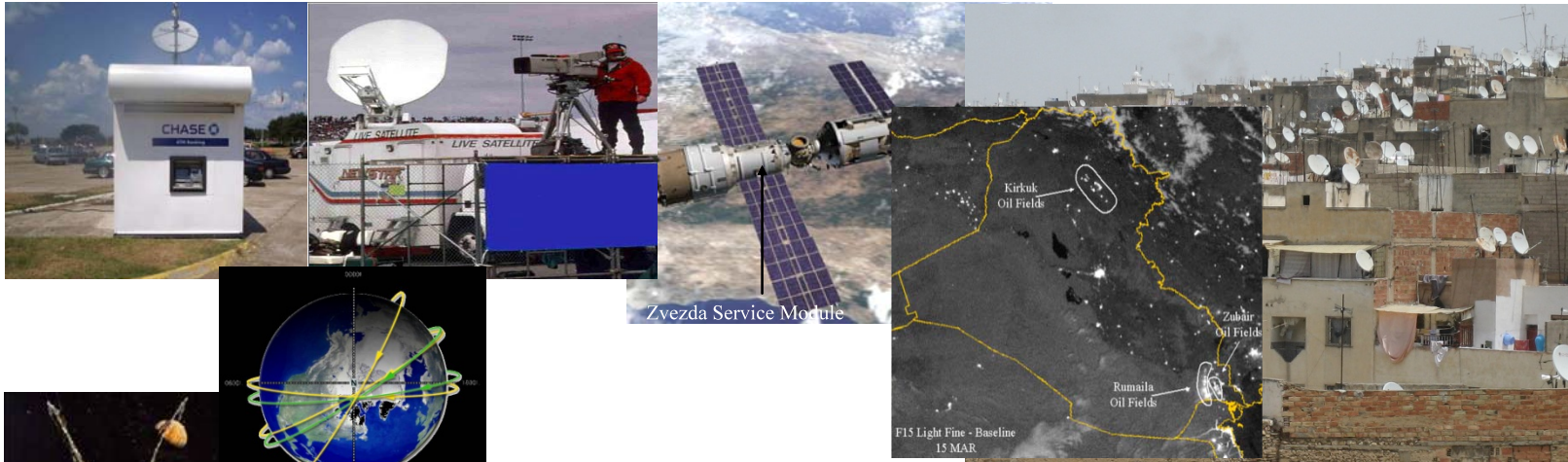
R-Scale

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Space Weather Impacts From Charged Particle Radiation



Satellite Damage
Radiation Exposure

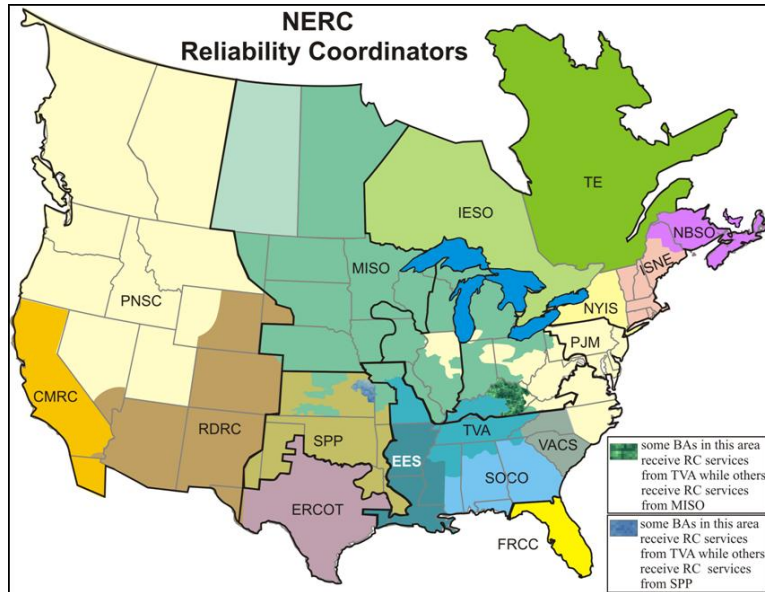
S-Scale



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Space Weather Impacts From Magnetized Blobs of Solar Material

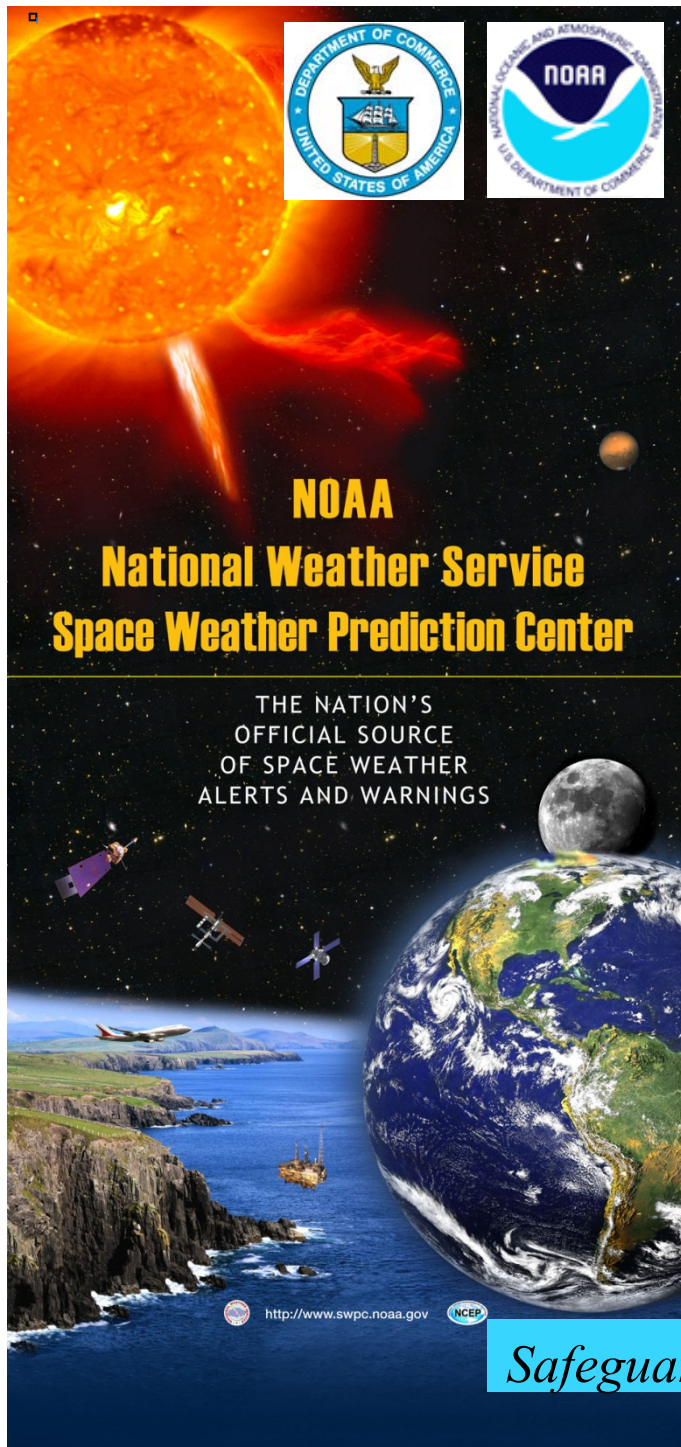


Transformer Damage
Grid Collapse
Pipeline Corrosion

G-Scale



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Space Weather Prediction Center

Our Mission: To provide space weather products and services that meet the evolving needs of the Nation.

Our Vision: A Nation prepared to mitigate the effects of space weather through the understanding and use of alerts, forecasts, and data products.

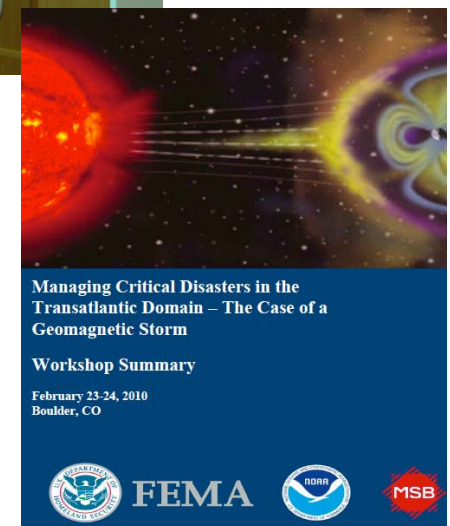
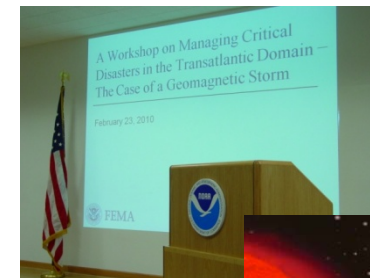
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Space Weather and Emergency Managers



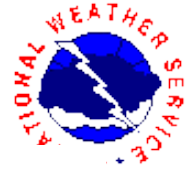
- FEMA Administrator Fugate visits SWPC
- FEMA Region VIII designated as Space Weather Center of Excellence for FEMA
- Workshop on managing space weather disasters in Transatlantic domain with EU/EC and Sweden held in Boulder (Feb 2010)
- SWPC brief FEMA Leadership at FEMA HQ and FEMA Regions
- Space weather warnings now distributed to FEMA National Response Coordination Center NRCC and FEMA Operations Center



Safeguarding Our Nation's Advanced Technologies



Meeting Our Society's Needs



Working with White House, Congress, and government leadership.

Coordinating on ways forward to develop and implement mitigation strategies to safeguard critical infrastructure from the impacts of severe space weather.

- **Secure High-voltage Infrastructure for Electricity from Lethal Damage Act (SHIELD Act)** (11 Feb, 2011)
- **Meeting at White House with National Security Staff and OSTP** (18 Feb, 2011)
- **Op Ed on space weather by Holdren and Beddington** (10 Mar, 2011)
- **Electric Infrastructure Security Summit (EISS) in Capitol building** (11 Apr, 2011)
- **President Obama's State Visit to UK** (24-26 May, 2011)

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The New York Times

The Opinion Pages

WORLD U.S. N.Y. / REGION BUSINESS TECHNOLOGY SCIENCE HEALTH

I.H.T. OP-ED CONTRIBUTOR

Celestial Storm Warnings

By JOHN P. HOLDREN and JOHN BEDDINGTON
Published: March 10, 2011

Weather is often in the headlines. But largely unnoticed last month was the weather that forced airlines flying the polar route between the United States and Asia to detour south over Alaska. This unusual routing was a response to a "space weather" event — an enormous ejection of charged gas from the Sun capable of scrambling terrestrial electronic instruments.

John P. Holdren is the science and technology adviser to President Barack Obama. John Beddington is the chief scientific adviser to Prime Minister David Cameron.

The New York Times

Opinion

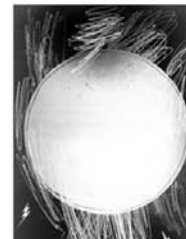
WORLD U.S. N.Y. / REGION BUSINESS TECHNOLOGY SCIENCE HEALTH
EDITORIALS COLUMNISTS CONTRIBUTORS LETTERS

OP-ED CONTRIBUTOR

The Sun Also Surprises

By LAWRENCE E. JOSEPH
Published: August 15, 2010

Los Angeles



DESPITE warnings that New Orleans was unprepared for a severe hit by a hurricane, America was blindsided by Hurricane Katrina, a once-in-a-lifetime storm that made landfall five years ago this month. We are similarly unready for another potential natural disaster: solar storms, bursts of gas on the sun's surface that release tremendous energy pulses.

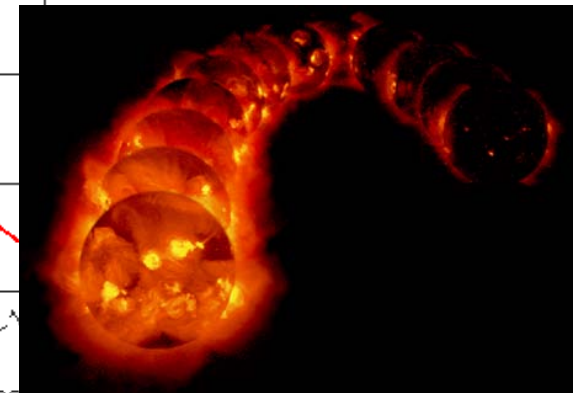
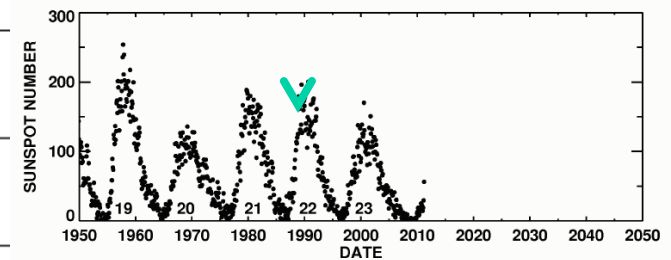
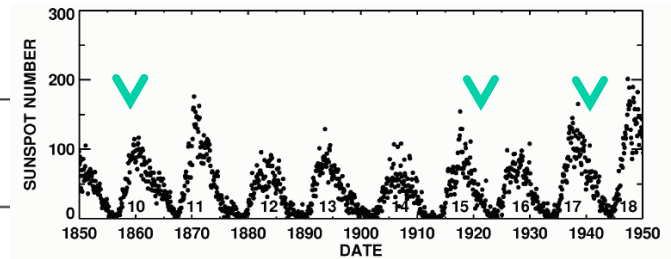
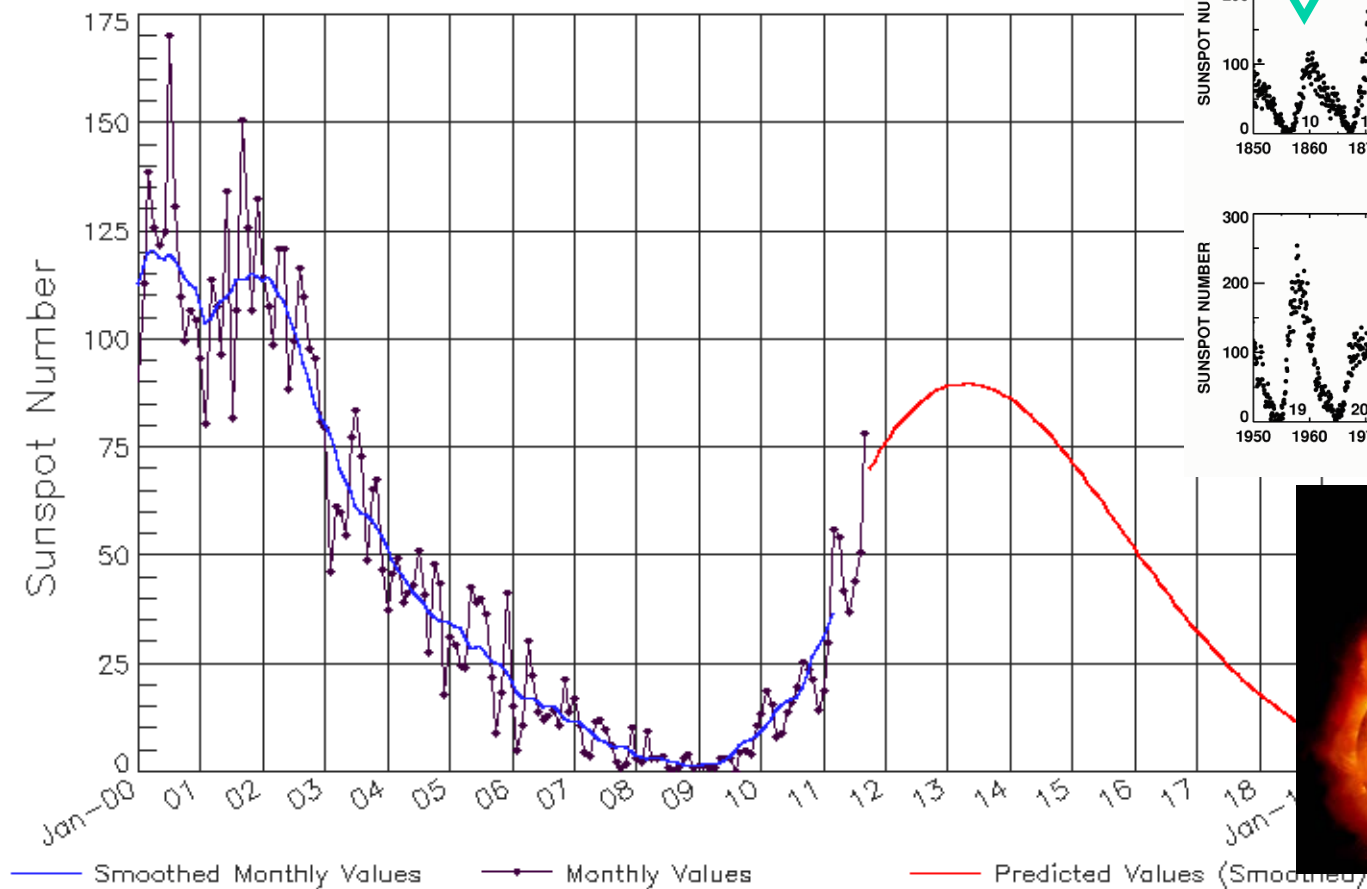




Space Weather Activity Cycle



ISES Solar Cycle Sunspot Number Progression
Observed data through Sep 2011

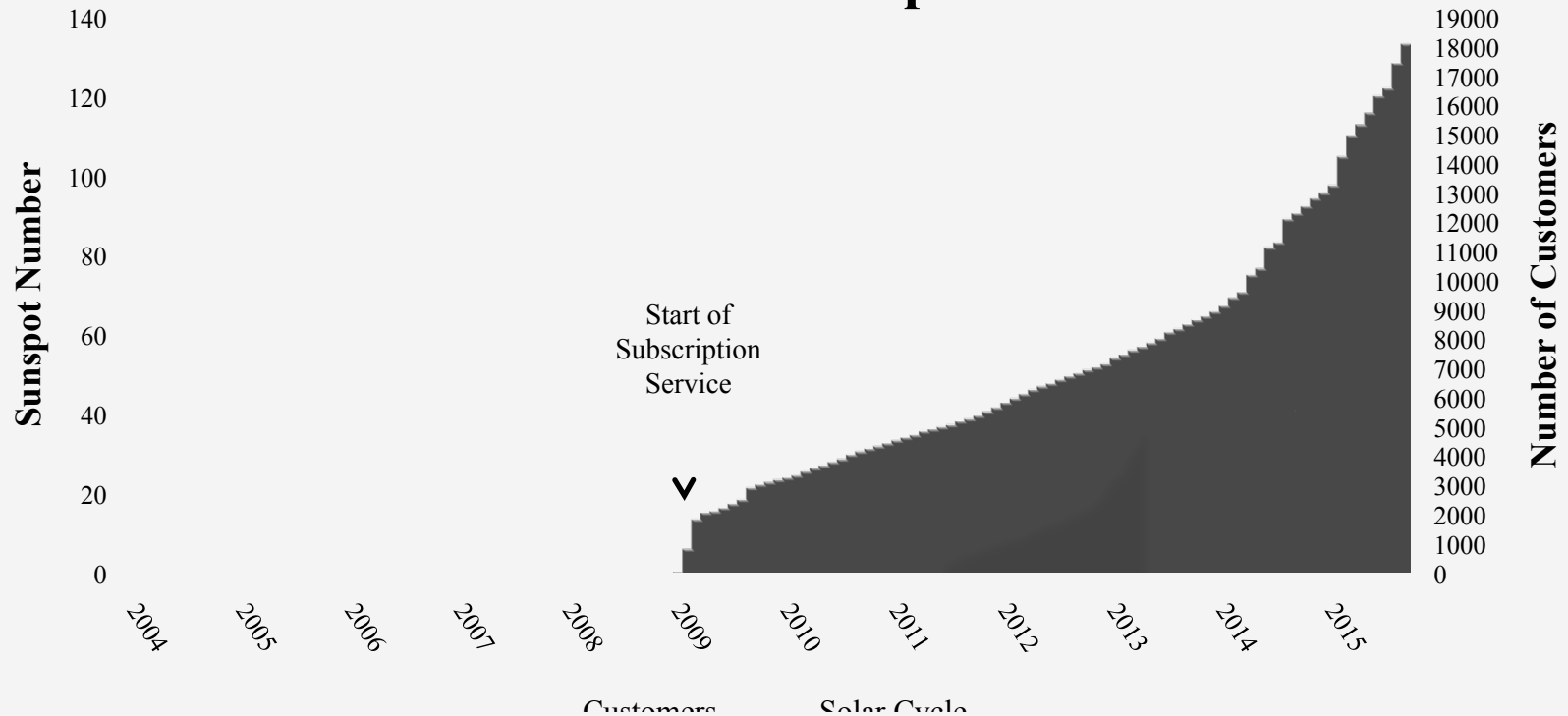


Updated 2011 Oct 4

NOAA/SWPC Boulder, CO USA

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Customer Growth SWPC Product Subscription Service



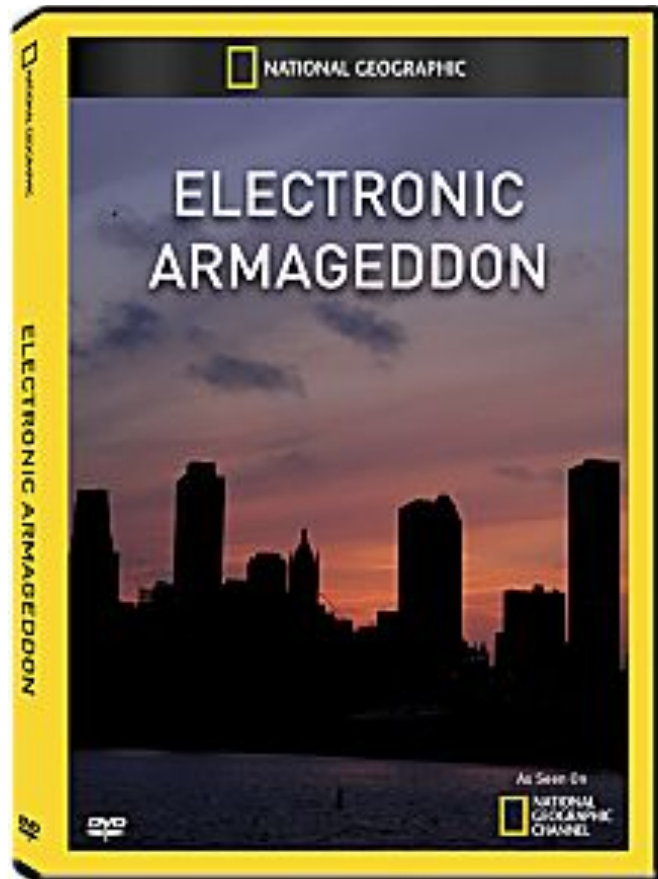
SES Satellite	Inmarsat	FEMA	Boeing	FAA
Alaska DOT	Chrysler	Motorola	British Petroleum America	Multiple Electric Utility Companies
Washington St. Dept of Transportation	John Deere & Caterpillar, Inc.	Major Airlines – UAL, AA, CO, Delta	United Launch Alliance	White House Office of Communications

Sample Recent Registrants

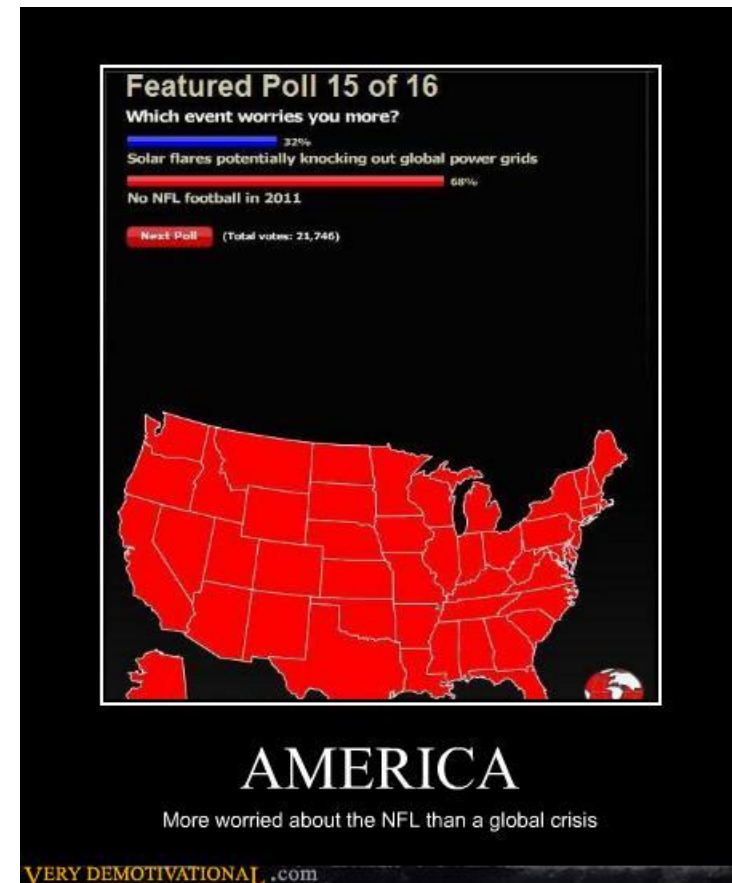
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Managing Expectations



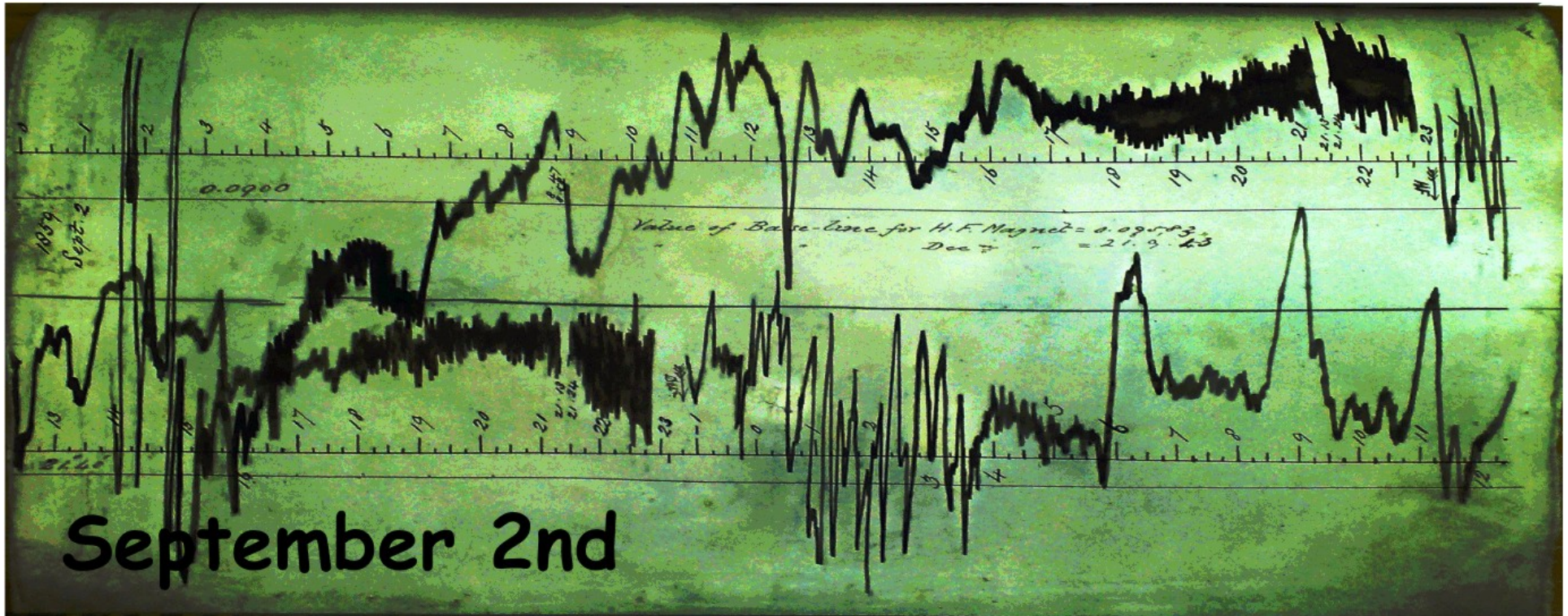
VS.



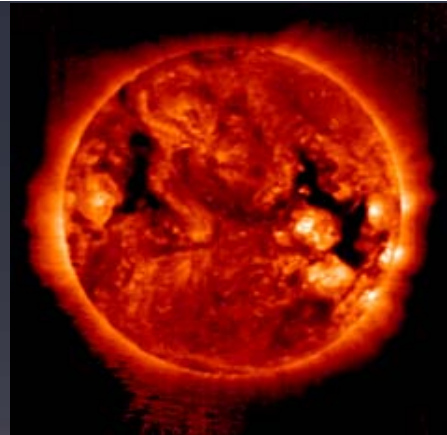
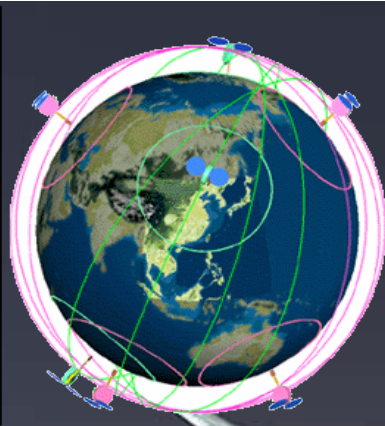
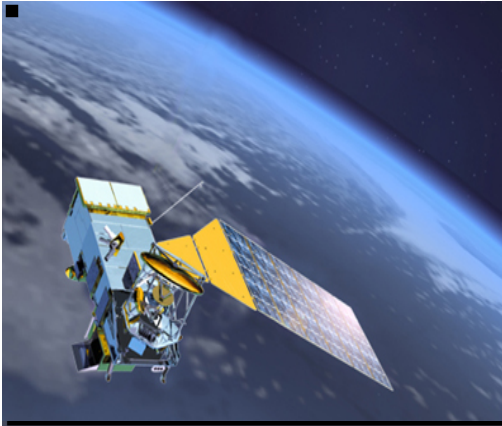
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The Final Word...?



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SWPC's Goal:

Provide the *right* information... in the *right* format...
at the *right* time... to the *right* people...
to make the *right* decisions

